Future Urbanization & Mega-Regions

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Market driven

Transformative change

Growth

Urbanization

Rise of the mega-regions

Congestion

Transformation

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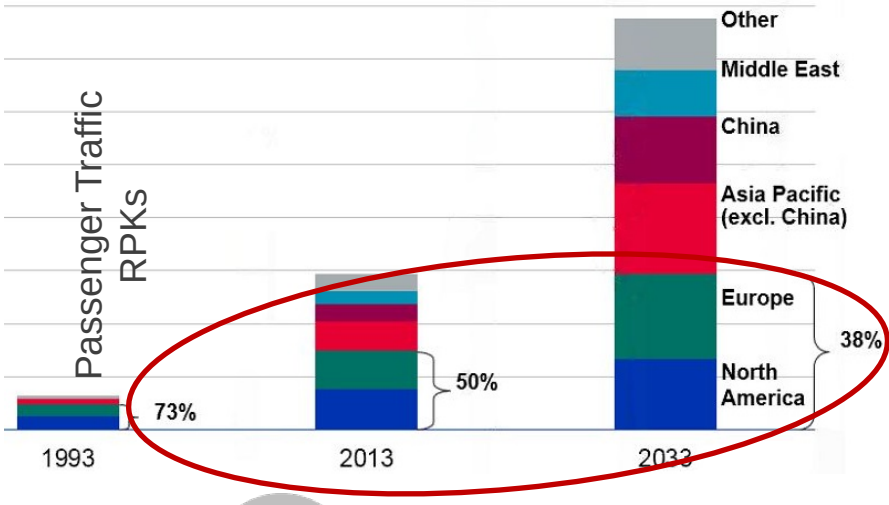
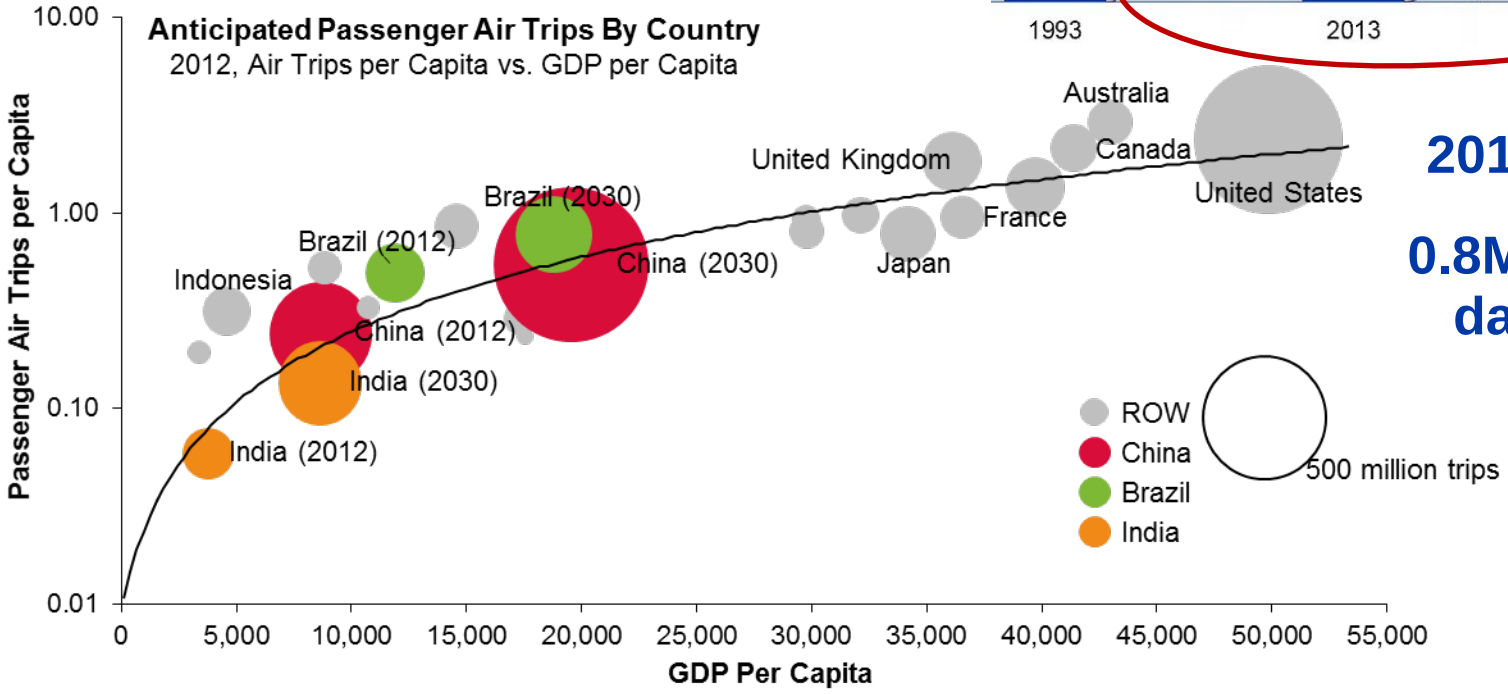
Growth = International

Majority air travel growth in China, India, and Brazil

Air more geographically diverse

- Emerging populations/regions:
  - 66% will travel in 2033
  - 2003 RPK share 39% → 52% 2013





2013 | 2033

0.8M → 2.2M daily pax

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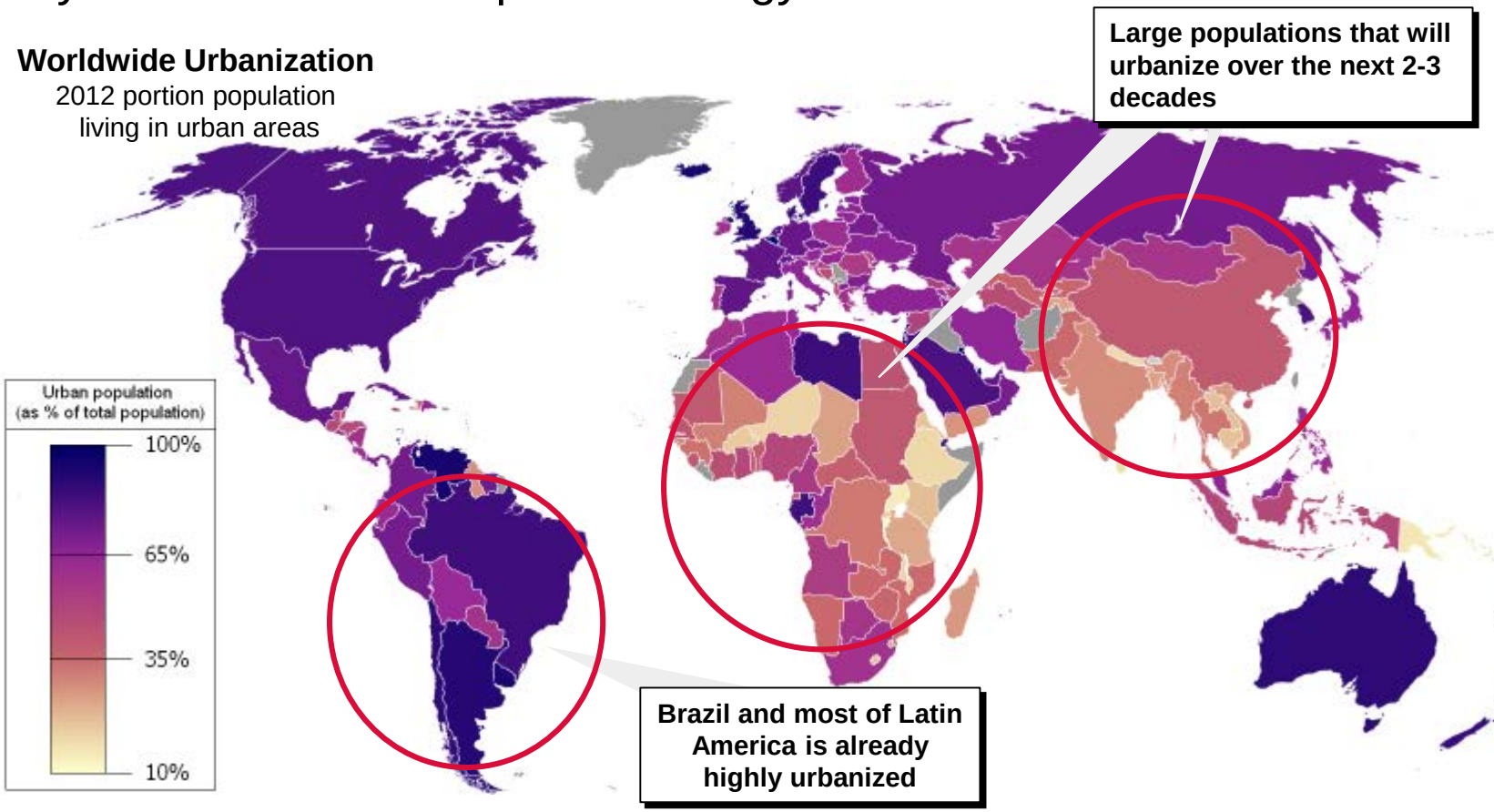
Agglomeration strongest urban market effect

May drive need for compatible energy as well as austere fields

Worldwide Urbanization

2012 portion population living in urban areas



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Urbanization growth will exacerbate hub transport pains

Per Capita GDP & Urbanization rate risen in tandem

1950 New York City

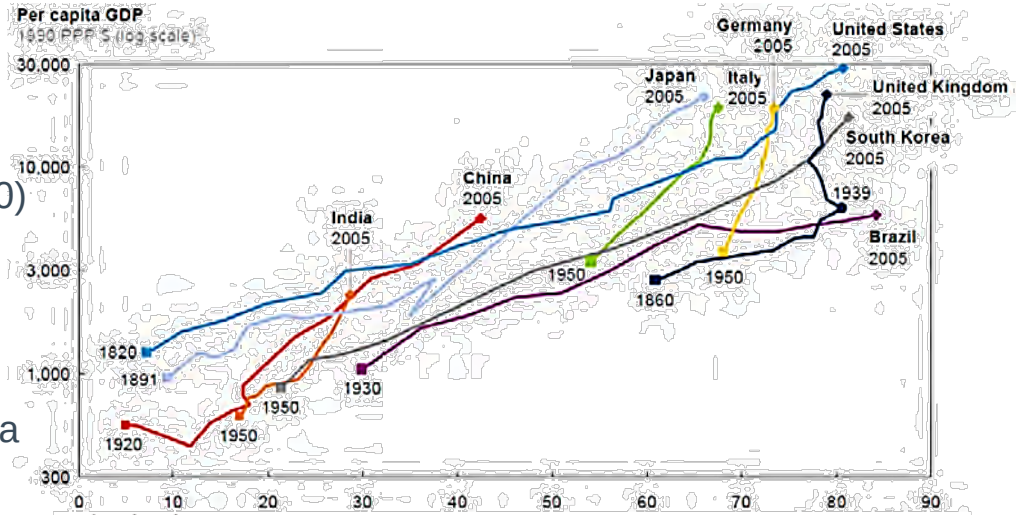
1st metropolitan area to hit 10M

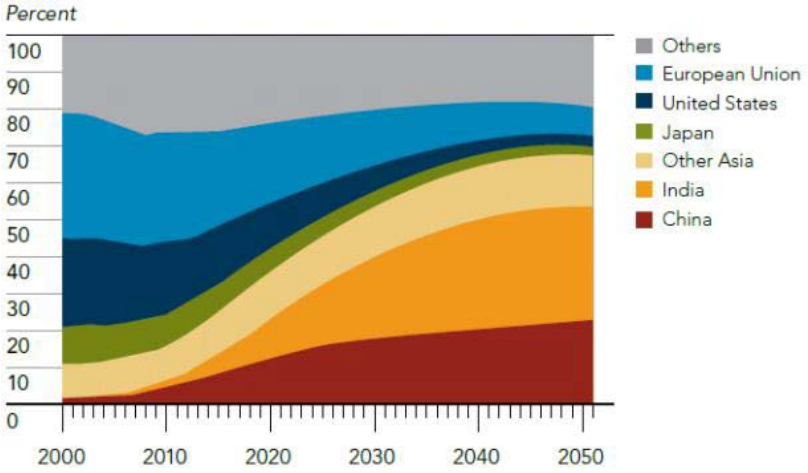
- Today 19 urban agglomerations (41 by 2030)

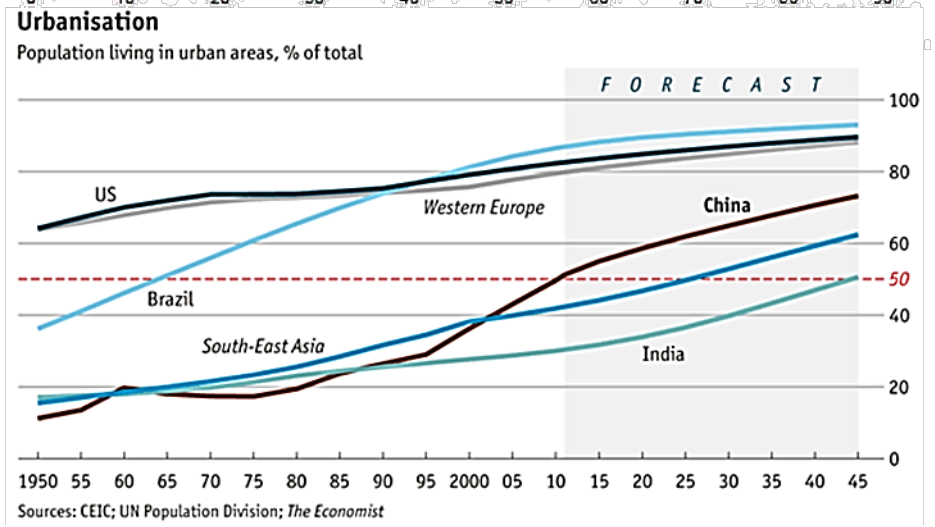
1962 Tokyo

1st city @ 10M Mega-city

- 2030 largest city 37M Tokyo-Yokohama area (~2% world GDP)
- Delhi 36M







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Global city urbanization following North American blueprint

… but faster & larger scales

Rapid population/urban growth

- New city (1M) every 5 days until 2050
- Adds 65M people/year (2.5B)
  - → 90% concentrated Asia/Africa
  - → 36% growth due to India (404M), China (292M) and Nigeria (212M)
  - → 5B world **urban** population → 2030
    6.4B to 8.4B → 2100

Today 59 countries > 80% urban

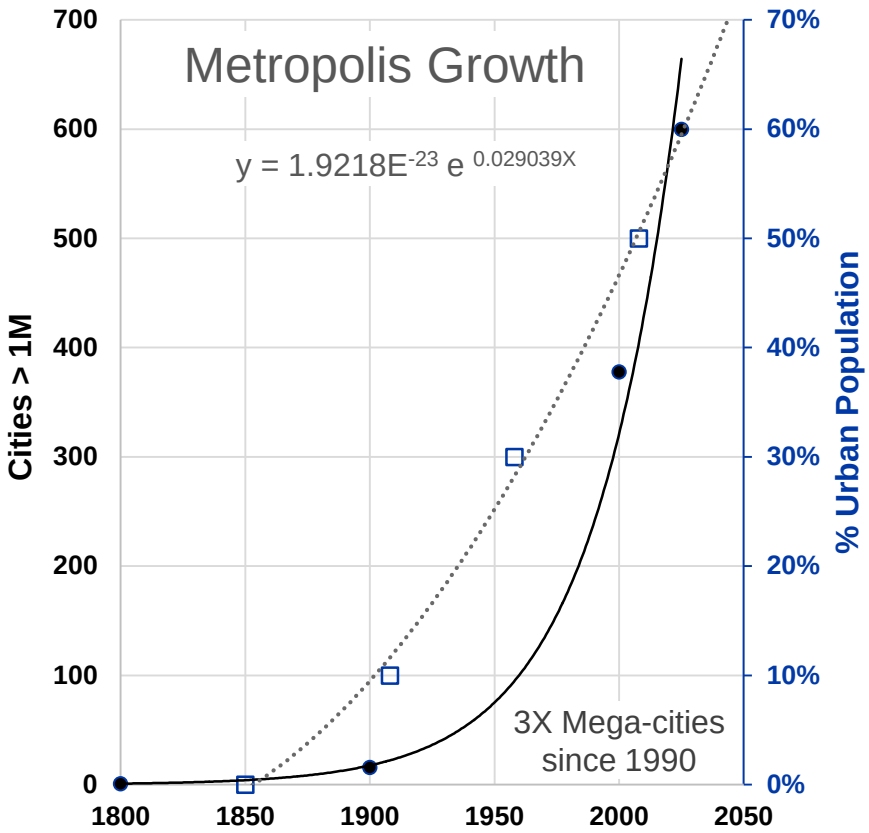
- → Belgium 98%, Japan 93%, Netherlands 90%, USA 82%, Latin America/Caribbean 80%, EU 73%
- → Africa/Asia 40/48 today 56/64 by 2050

89 countries by 2050

- → 196 countries today total

More evident in developing countries

- China highest



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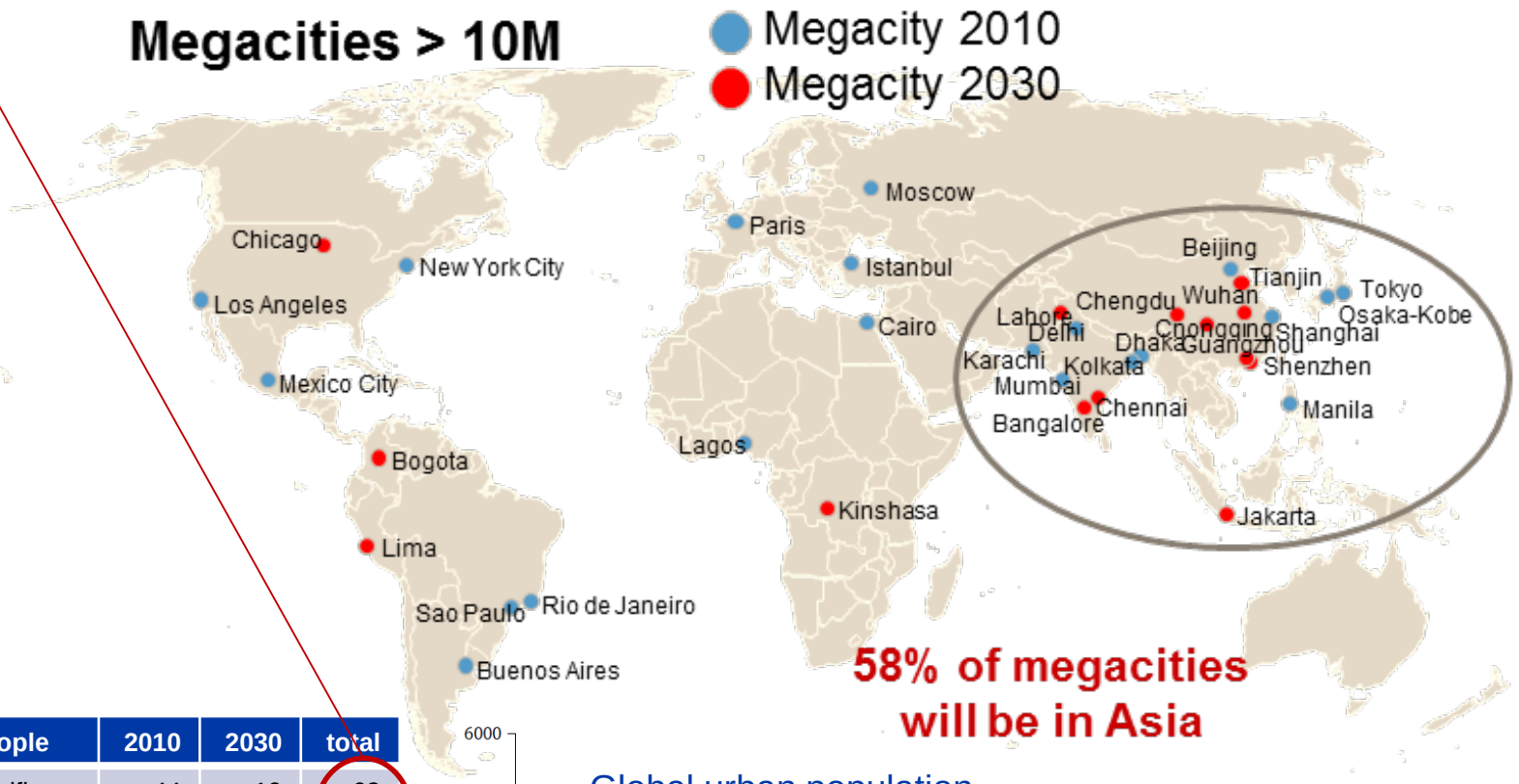
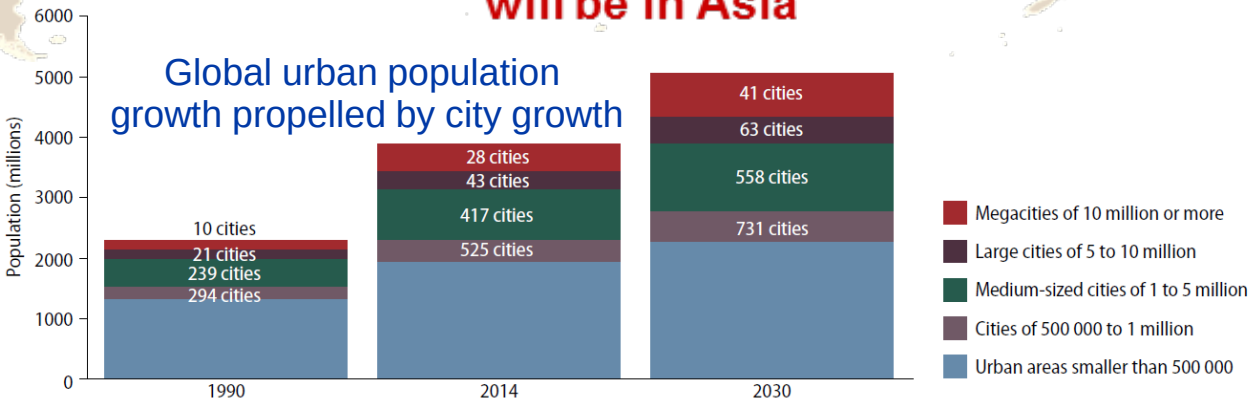
GDP & urban megacity agglomeration rise

55% large cities will be in Asia



2M+ people	2010	2030	total
Asia/Pacific	44	19	63
China	43	12	55
Africa	21	25	46
Latin America	29	9	38
India	15	16	31
North America	24	5	29
Europe	16	0	16



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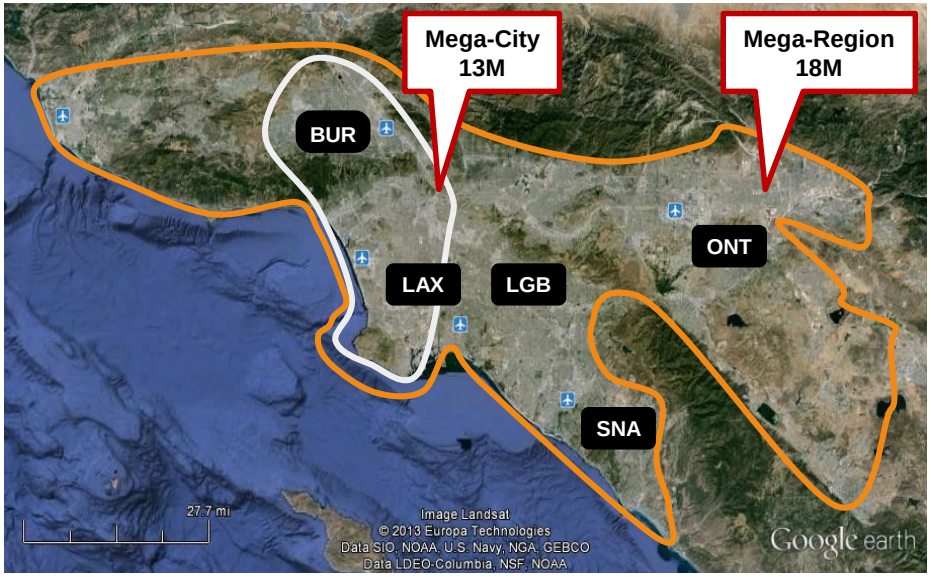
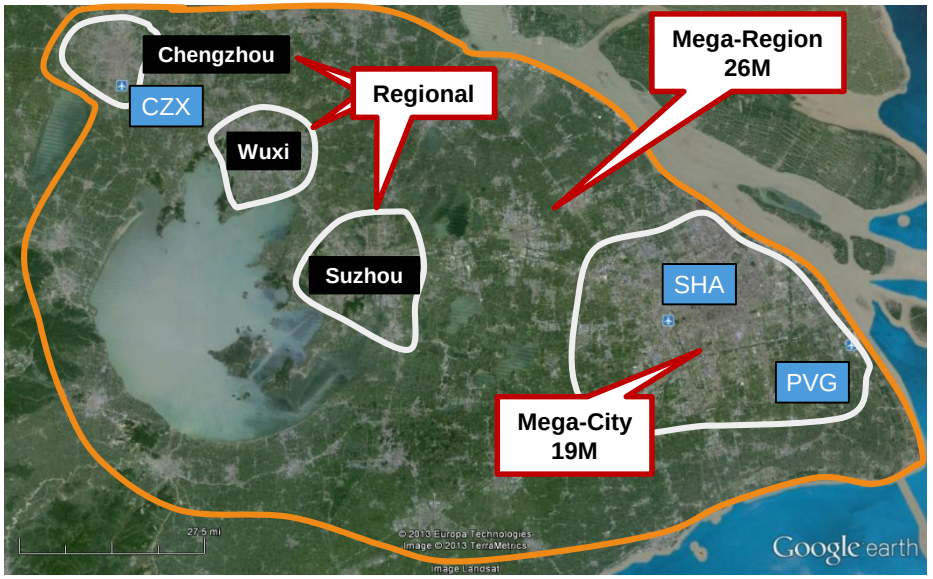
Mega-cities anchor Mega-regions

Multiple city clusters/airports, often 100+ miles across

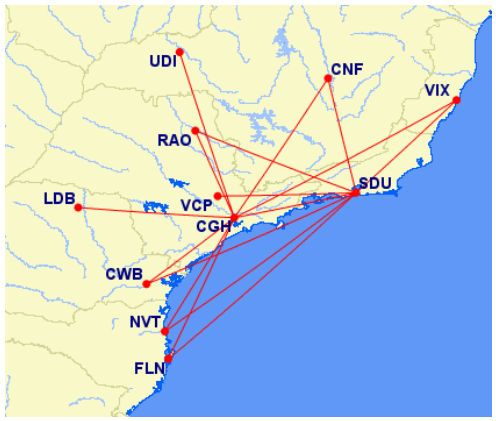
Megacity and Mega-Region
Los Angeles 2013



Mega-City & Mega-Region
Shanghai 2013



Rio & San Paulo > 50M



Central India > 90M

Shanghai > 100M

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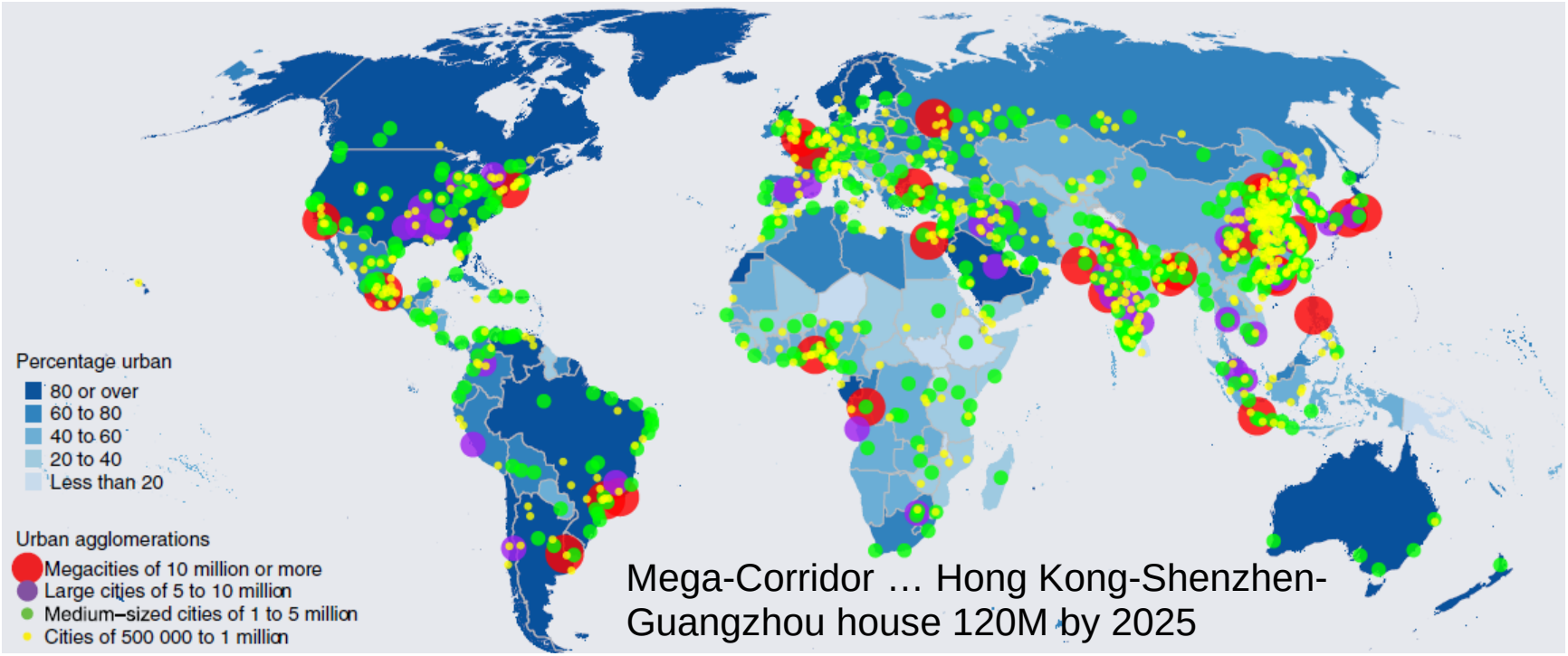
Urbanization → Mega-City agglomerations

Mega-Region variations represented by Archetypes



Single-City

New York, Los Angeles, Chicago, Mexico City, Buenos Aires, Lima, Bogota, Istanbul, Moscow, Paris.

Developing:
Shanghai, Chongqing, Chengdu, Wuhan, Manila, Jakarta, Karachi, Lagos, Kinshasa, Cairo.

Dual-City

Tokyo & Osaka
Sao Paulo & Rio de Janeiro
Johannesburg/Pretoria "Jotoria"

Developing:
Beijing & Tianjin, Delhi & Lahore, Kolkata & Dhaka

Multi-City

Mumbai, Chennai, Bangalore, Hyderabad

Mega-Corridor

Guangzhou, Shenzhen, Hong Kong will house 120M people by 2025

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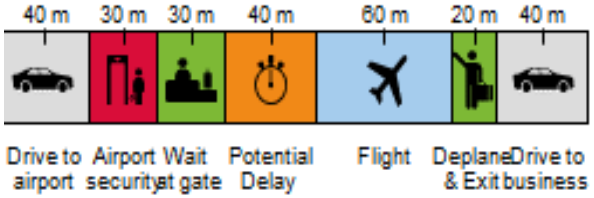
Growth chokes central hub-n-spoke

Air/Office parks serve expanding metropolitan business regions

Finite infrastructure can't accommodate growth

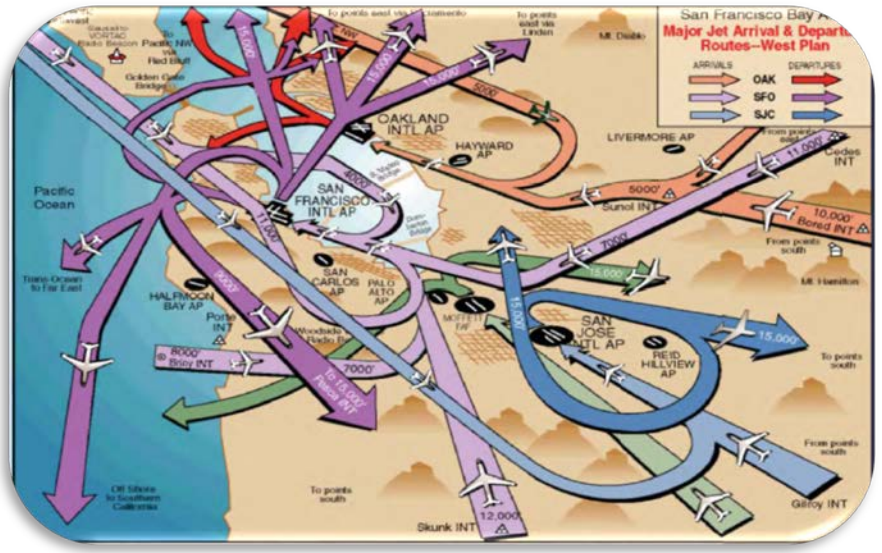
- Airports congested/saturated
  - Long & invasive security queues
- More traffic, more noise, more pollution

Door-to-Door



Gridlocked ATM

- Limited gates/ramps
- Fewer takeoff/landing slots
- Landlocked runways



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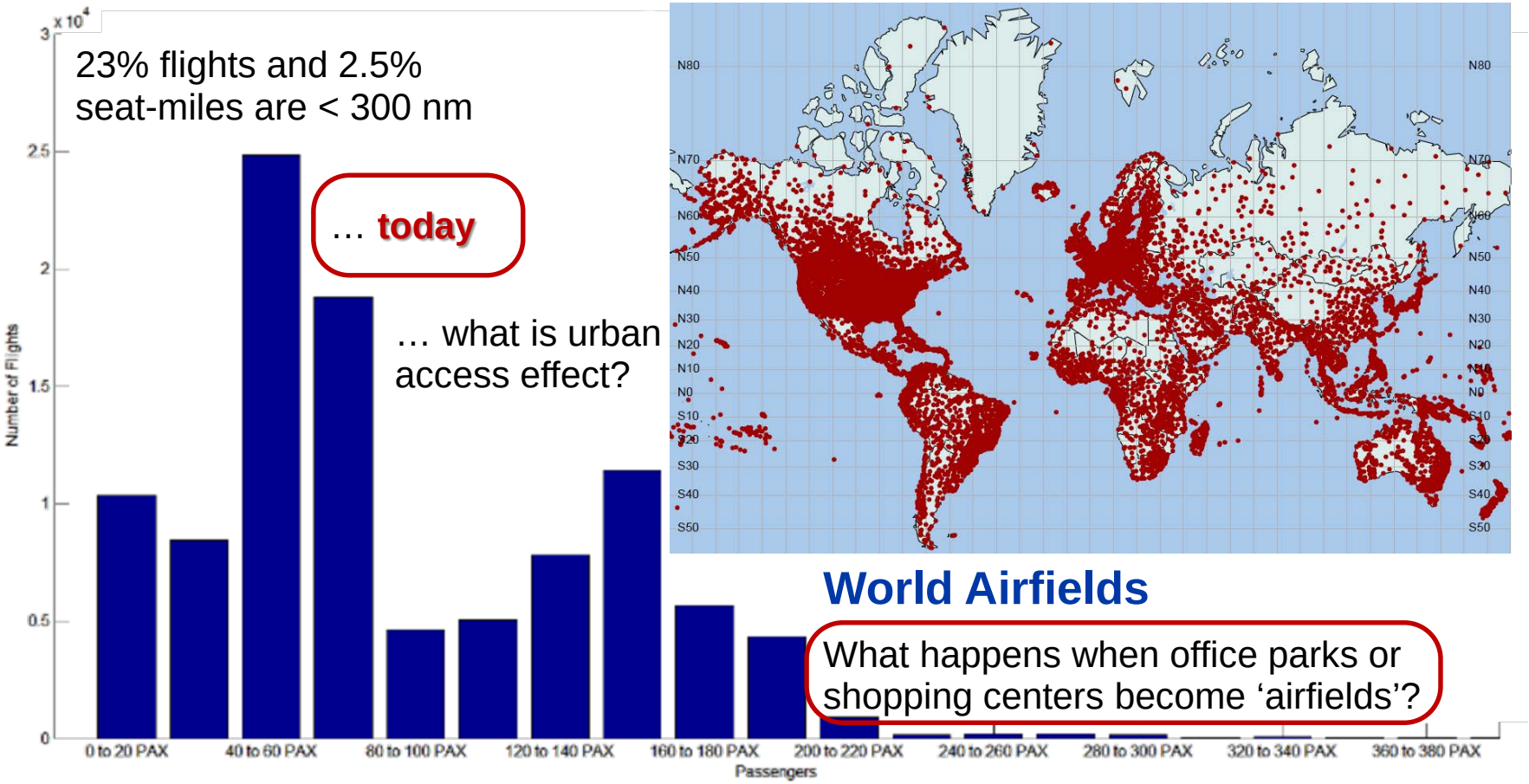
It’s difficult to make predictions, especially about the future.

Danish Proverb

Dispersed & Dynamic freedom can vividly alter current Centralized & Static airfield paradigm



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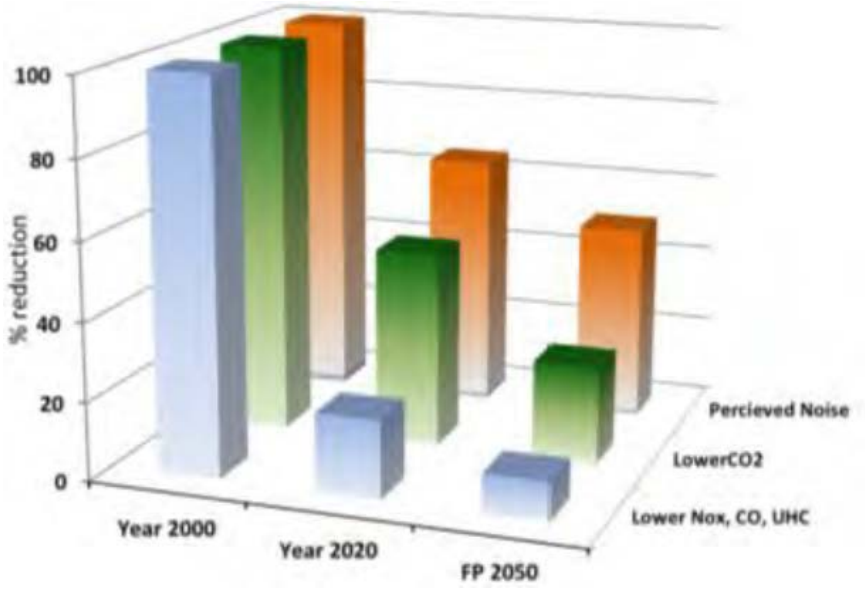
Urban community acceptance

Hub-n-Spoke → Door-to-Door (noise/Safety critical)

Airpark urban access

- V/SSTOL
- Near Silent (< 60 dBa)
- Zero emission (goal)
  - Lower (objective), Compliant (threshold)
  - 90% Nox, 75% CO2 /pax-km



Safety

- Robust, forgiving
- Perceived .vs. Actual
- Reliable ≠ Safe

Comfort & Convenient

- Non-evasive security
- Improve overall transit

Affordable

- Flexible/available 24x7
  - Relieve congestion
  - Low barrier infrastructure
  - Avoid curfews, fines or bans
- Low costs (build, acquire, operate)
- Durable, RM&S
- Available/Compatible energy

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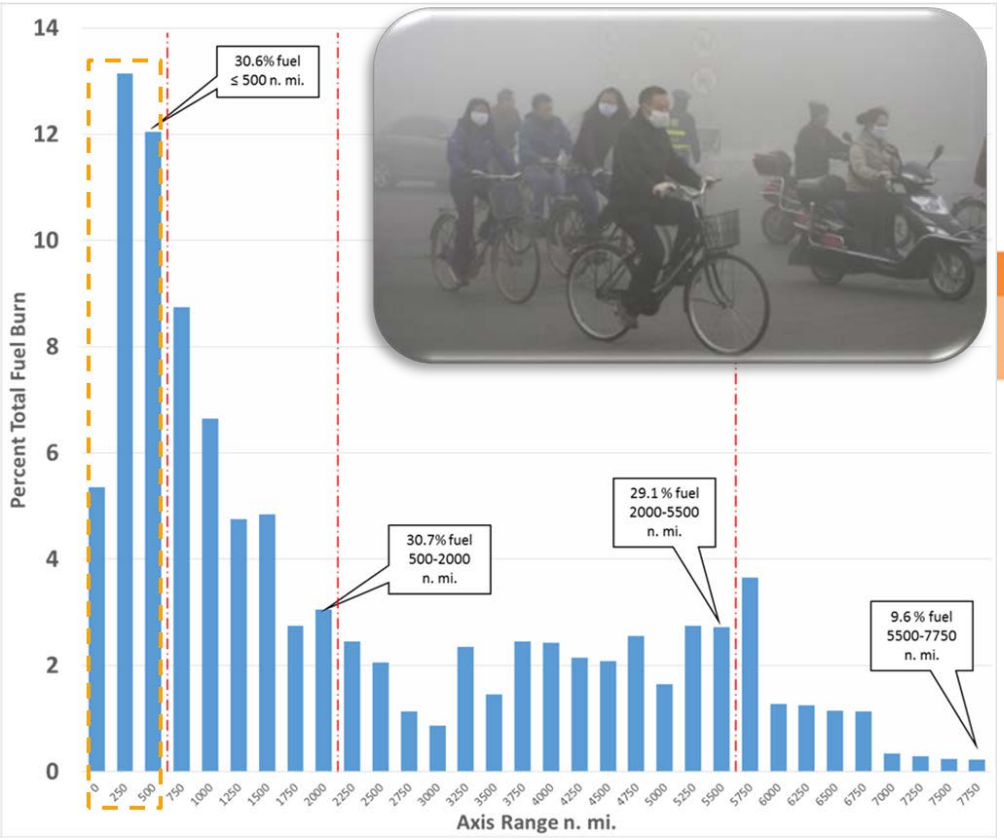
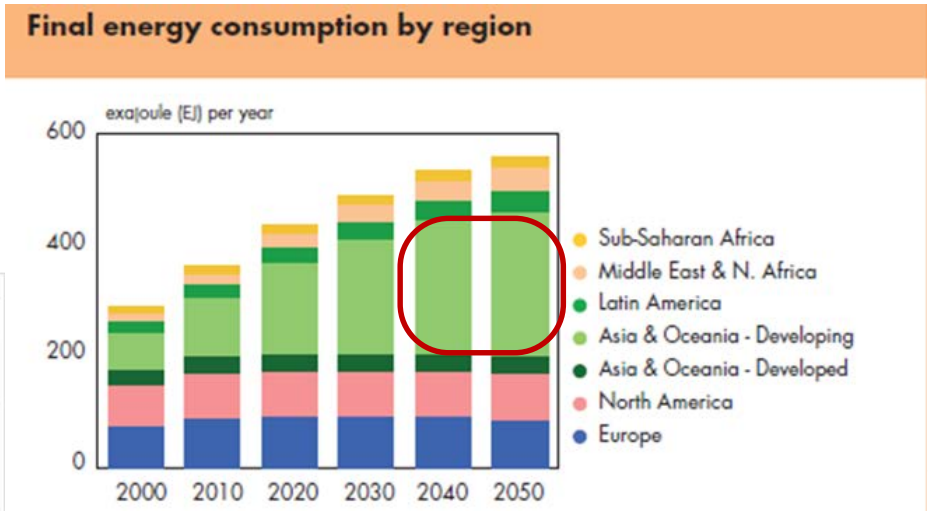
What if energy was 1/10th cost and renewable?

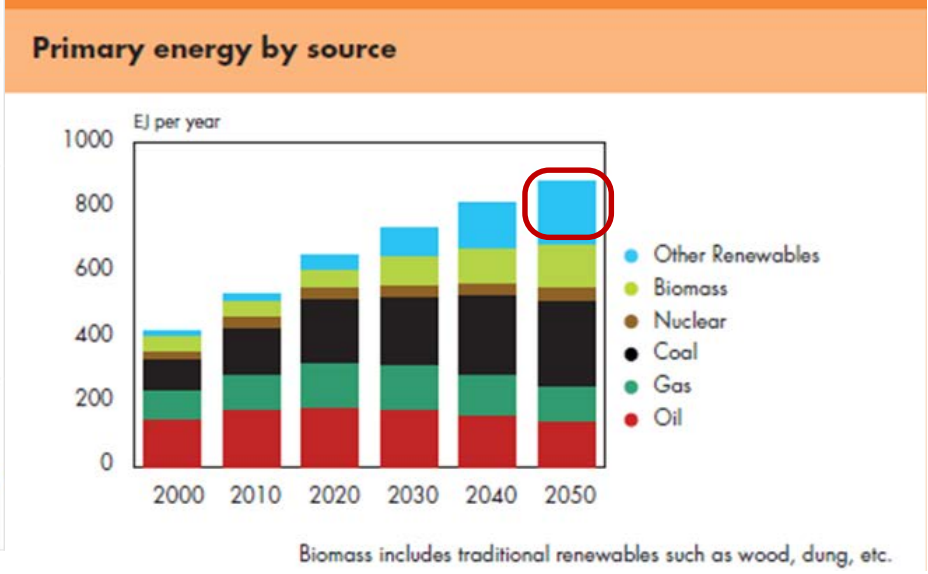
The definition of insanity, is doing the same thing over and over, and expecting different results.“ - Rita Mae Brown

Leapfrog development stages

→ Avoid paths others passed through
(e.g. China cells vs US lines)







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Accelerating change acceptance

Quicker absorption by developing states

Rapid disruption adaptation

- UBER, LYFT, SIDECAR

What's next?

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Evolution or Revolution?

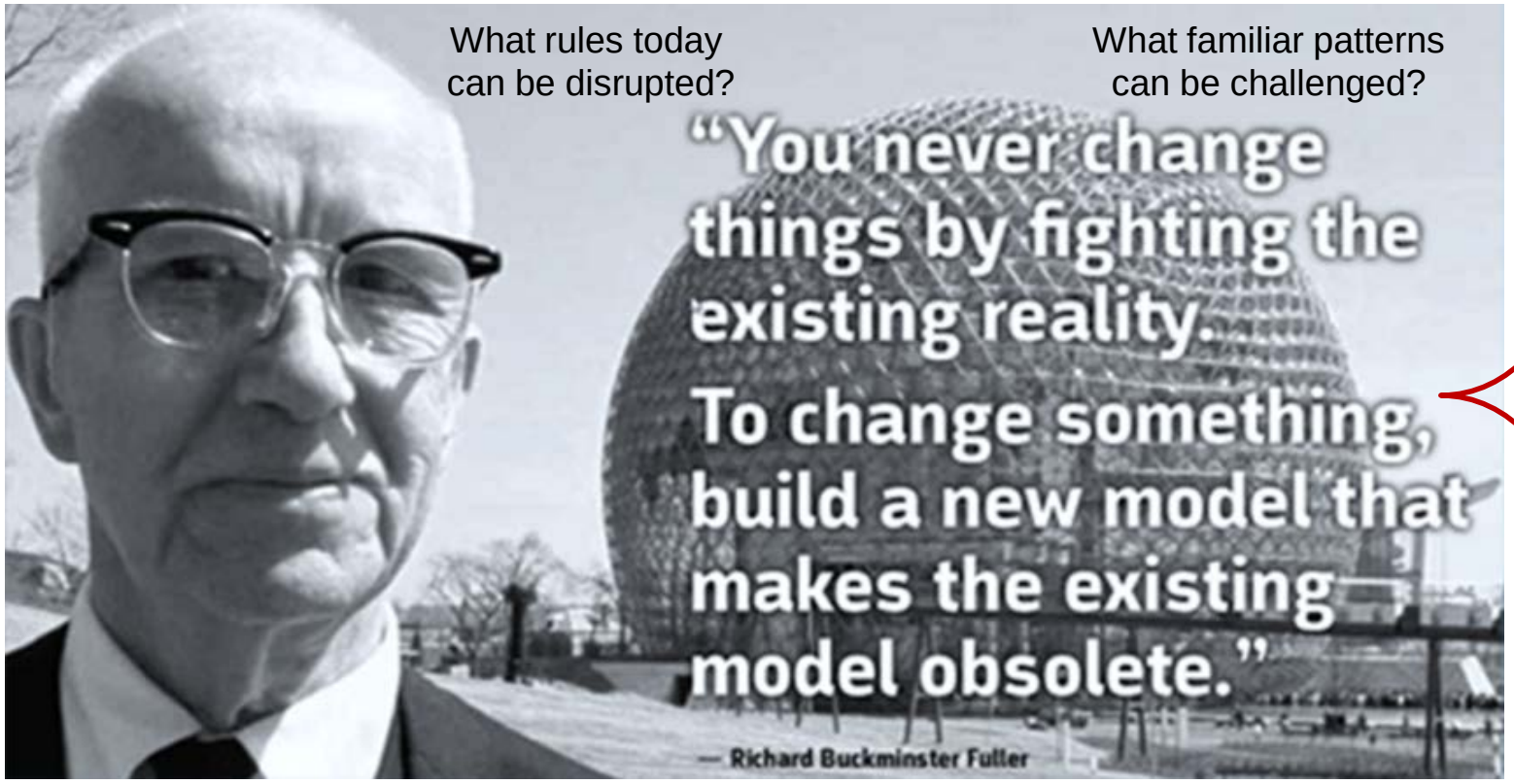
Given lemons, make lemonade

Central hub-n-spoke → → →

Big aircraft + long range + high speed = more energy

Dispersed point-2-point

Small aircraft + short range + low speed = less energy = No/low Noise/emissions



TRANSFORMATION

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Emergent market challenges motivate

Safety + Silence + Emissions + V/STOL + Affordable

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Why not explore new urban mobility market?

Workshop should seek/develop advocacy

Access what was once inaccessible

→ Connect/reach nodes with little or no service

Productivity

→ Minimize non-value time

→ Multi-destination quick & efficient

Responsibly to environment

Improve safety/security

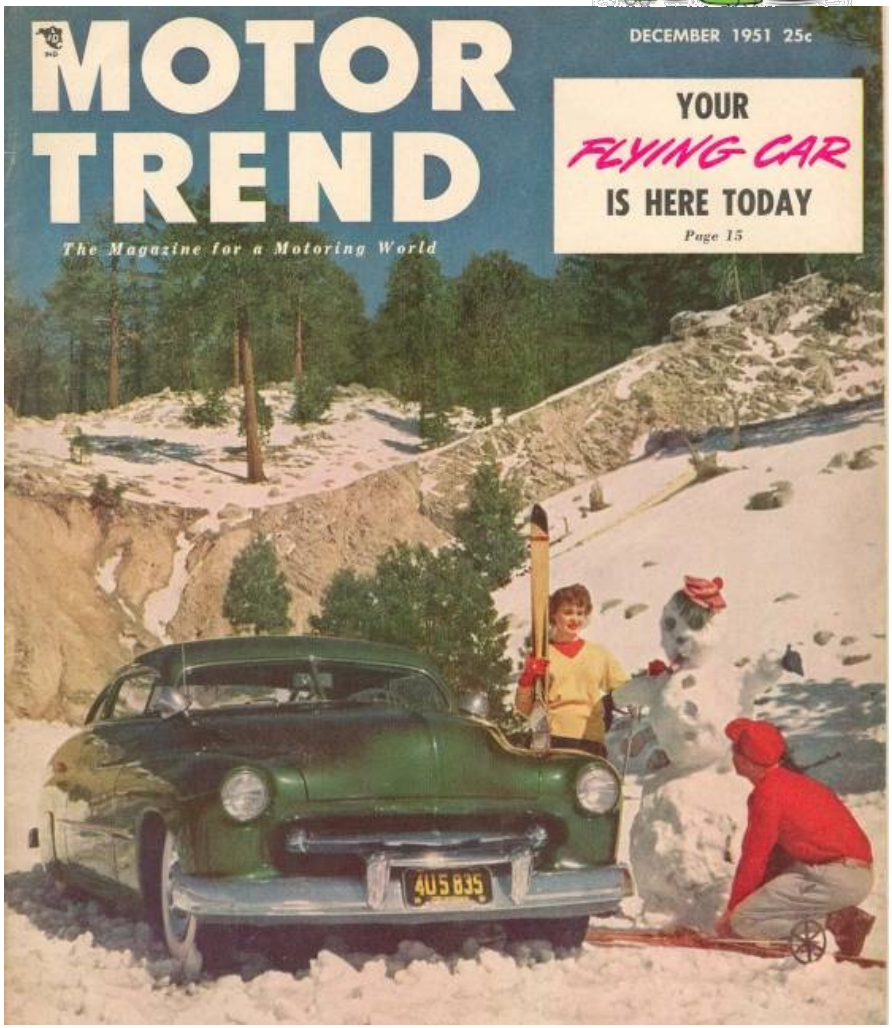
Dynamic & flexible

→ Schedule

→ Mission: Cargo, medical, humanitarian, etc.

Charge entrepreneurial spirit

→ Kick start new industries



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No free lunches

Questions?

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